

The weights of men in a particular age group have mean $\mu = 170$ pounds and standard deviation $\sigma = 24$ pounds.

1.) Imagine we want to take a random sample of $n = 16$ men from this population. To make an inference based on these 16 men, we'd have to think about what the sampling distribution would look like. In other words, if we were able to take all possible samples of size $n = 16$ from this population, what would the mean and standard deviation of the sampling distribution of means be?

2.) Would the sampling distribution be normal if we took all possible samples of $n = 16$ from this population of men?

3.) What would change about the sampling distribution if we took a random sample of $n = 64$ men, rather than $n = 16$ men?

Sampling distribution based on $n = 16$ men	Sampling distribution based on $n = 64$ men
Shape:	Shape:
Center:	Center:
Spread/Variability:	Spread/Variability:

If the sampling distribution is approximately normal, we can apply what we know about normal distributions to answer certain questions. We know that when a distribution is normal, we can use the Empirical Rule. We also know that we can convert values in a normal distribution to z-scores or standardized scores, and these z-scores will tell us how many standard deviations a value falls from the mean of the distribution. In a sampling distribution, the mean is μ .

Applying our knowledge of the standardized normal distributions, z-scores, and probability.

4.) Let's say you plan to take a sample of size $n = 64$ from this population of men. We know, based on the Empirical Rule, that 68% of the normal distribution falls within 1 standard deviation of the mean. For a sampling distribution, this means that 68% of the sample means fall within 1 standard deviation of the mean. In sampling distributions, how do we define 1 standard deviation? So 68% of your data falls within what range?

5.) Using the same logic as in problem #4, can you find the middle 95% of our sampling distribution by applying the Empirical Rule?

6.) Let's think of another question. Let's say I tell you that I take a random sample of size $n = 64$ from this population, and I find the sample mean to be $\bar{x} = 172$ pounds. Is this result consistent with the belief that the true population mean is $\mu = 170$ pounds? In other words, does our sample mean support this claim about μ , or would it be very unlikely that we'd obtain this sample mean if $\mu = 170$ pounds? What if we had a sample mean of $\bar{x} = 180$ pounds?

7.) One final question to bring all our knowledge together: Let's say that I take a random sample of size $n = 35$ from this population of men.

a.) Find the probability that they have a mean weight less than 167 pounds. Is this sample mean unusual?

b.) Find the probability that they have a mean weight greater than 184 pounds. Is this sample mean unusual?